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COMPLETE SPECIFICATION

Methods of Coating or Lining Articles with a Layer of Polyvinyl Chloride or like Synthetic Thermoplastic Substance

I, NORBERT HAGEN, a German Citizen, of 36, Ringstrasse, Sieburg, Rhineland, Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to methods of coating or lining articles with a layer of polyvinyl chloride or a synthetic thermoplastic substance having similar properties.

The object of the invention is to provide an improved method of coating or lining articles utilising the property exhibited by the above-mentioned substances of being considerably more elastic at high temperatures below their melting points, than at low temperatures.

The present invention provides a method of coating an article with a layer of polyvinyl chloride or like synthetic thermoplastic substance which comprises the steps of heating the substance and forming it into a tube, under-mentioned compared with the article, cooling the tube from the temperature at which it was formed, reheating the tube, dilating it and cooling it to stabilize the dilated form, fitting the tube on the article, and finally reheating the tube to restore its elasticity so that it contracts and adheres closely to the article.

After having attained a sufficient expansion, which may reach 300 per cent. or more with soft-formed polyvinyl chloride, the coating is cooled while it is still stretched. Thus, cold water or cold air is forced in, or it is even possible to apply external cold treatment which draws off the inherent heat of the stretched coating mass. With the withdrawal of the heat, the elasticity disappears, so that the coating remains in its stretched state.

The coating is now guided over the article to be covered, so that it encloses the latter entirely or at desired places. At this stage, the coating still does not fit and may even have folds or creases at different points. It is then heated afresh. This renewed heating may, for example, be affected by radiation with a stream of hot air, or in a heating chamber or in any other manner. Owing to the heating, the original elasticity of the coating returns and the coating shrinks in such manner that it adheres closely to the contours of the article to be covered.

If a hollow article is to be lined with a layer of polyvinyl chloride or like synthetic thermoplastic substance, then, in contradistinction to the method of coating described above, the invention provides a method which comprises the steps of heating the substance and forming it into a tube overdimensioned compared with the article, cooling the tube from the temperature at which it was formed, reheating the tube, stretching it and cooling it to stabilize the stretched form, introducing the tube into the hollow article and finally reheating the tube to restore its elasticity so that it expands and adheres closely to the article.

Particularly when a comparatively hard coating is desirable, the synthetic thermoplastic substance is softened with an easily removable swelling medium. Benzene, trichlorethylene or the like may for example be employed, as such swelling media. The softened substance is again expanded or contracted as before and brought into contact with the article. During the final heating operation the swelling medium evaporates and the substance tends once again to assume its original condition. It shrinks or dilates and thus adheres closely to the article. The removal of the swelling medium may be accelerated by the use of a suitable solvent.

Thus, for example, straight or curved tubes may be covered or lined with a polyvinyl layer in the manner described. This procedure may be used, for example, with steel furniture and in the chemical industry, in connection with bicycle handle-bars, baby-carriage handles as well as any other handles, supporting rods, switch levers, clinical instruments and the like. Hoses, particularly high-pressure hoses, may be obtained in a similar manner in that, at will, a covering or a lining may be applied on the outside or the inside, respectively, of a helically formed metal hose or of a correspondingly formed fabric or textile material. Covered parts for motor vehicles or for the building industry may be quickly and cheaply covered in this manner, even when they are of complicated

shapes. Any thickened portions up to two or three times the normal diameter do not interfere with this method being used. It should be obvious from the foregoing explanations that even chains and cables, e.g. for locking a bicycle or for similar purposes, can be covered in the manner described. The examples given do not in any way exhaust the possibilities for which the method may be employed.

It is clear that the range of elasticity of the substance in tubular form must be sufficient to accommodate itself to allow for variations in the width of the original rough shape. If an even better adhesion of the layer of polyvinyl chloride is desired, the layer may be coated beforehand, on its surface which is later to be the adhering surface, with a known solvent or adhesive. This solvent may obviously be applied to the adhesion surface of the article to be covered.

The elasticity of soft-formed synthetic thermoplastic materials such as polyvinyl chloride is greater than with hard masses. Generally speaking, therefore, the method according to the invention may be carried into practice more easily and more effectively with a soft material than by using a hard-set material. If it is necessary to provide a comparatively hard covering on bends or over curvatures, then it is possible to proceed in the manner already mentioned, that is, the synthetic thermoplastic substance is first of all softened by mixing in some softening agents, which are subsequently removed during the final heat treatment. The removal of the softening agents may be facilitated by dissolving out with a suitable solvent. Such softeners, which industrial technicians usually do not like using because of their imperfect stability and which, on the other hand, are quite generally known, may be used with advantage in the present case. By selecting a suitable mixture between removable and stable softeners, the character of the finished covering can be extensively adapted to practical requirements.

Flexible hoses produced in accordance with this method may be cut open longitudinally to provide foils and bands which will stretch in all directions. This foil is used with very great advantage, for example, for covering spherical surfaces, packing, and so on.

The extrusion of polyvinyl chloride generally takes place at about 140° and a tubular form assumed at this temperature can be considered as permanent. Then the hose or the tube is heated to about 100°—110° C. and then the expansion or contraction is carried out. Following on this, the expanded or contracted shape is temporarily stabilised by a further cooling. The temperature at which the elasticity is sufficiently reduced is in the region of 40° or below. After the material is placed around or inside the article, the original elasticity is again made effective by raising the temperature to about 100—120° or higher until the desired tight application of the covering or lining is achieved. The various temperatures fluctuate according to the nature of the coating or lining material.

Articles of various materials, such as for example iron, metal, wood or ceramics may be provided with a coating or a lining of polyvinyl chloride or like synthetic thermoplastic substance by the process according to the invention.

What I claim is:—

1. A method of coating an article with a layer of polyvinyl chloride or like synthetic thermoplastic substance which comprises the steps of heating the substance and forming it into a tube, under-dimensioned compared with the article, cooling the tube from the temperature at which it was formed, reheating the tube, dilating it and cooling it to stabilize the dilated form, fitting the tube on the article and finally reheating the tube to restore its elasticity so that it contracts and adheres closely to the article.

2. A method of lining a hollow article with a layer of polyvinyl chloride or like synthetic thermoplastic substance which comprises the steps of heating the substance and forming it into a tube over dimensioned compared with the article, cooling the tube from the temperature at which it was formed, reheating the tube, stretching it and cooling it to stabilize the stretched form, introducing the tube into the hollow article and finally reheating the tube to restore its elasticity so that it expands and adheres closely to the article.

3. A method of coating or lining an article in accordance with Claim 1 or Claim 2, wherein a solvent for the thermoplastic substance, or an adhesive, is applied either to the surface of the tube which is to adhere, or to the surface of the article which is to be coated or lined, before the tube and the article are brought into contact.

4. A method of coating or lining an article in accordance with Claim 1 or Claim 2, wherein the thermoplastic substance is softened by the use of a swelling medium or softening agent prior to final reheating.

5. A method of coating or lining an article in accordance with Claim 4 wherein removal of the swelling medium or softening agent is accelerated by dissolving out with a solvent.

6. A method of coating or of lining an article with polyvinyl chloride or like synthetic thermoplastic substance substantially

as herein described.

7. An article when coated or lined with polyvinyl chloride or like synthetic thermoplastic substance by the method claimed in any of the appropriate preceding claims.

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